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(54) ROTARY ELECTRIC SWITCH

(71) We, IMI SANTON LIMITED, a British Company, of Somerton Works, Newporth, Monmouthshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to rotary electric switches of the type in which switching members are enclosed within casings which are located axially along a driven rotary spindle and are provided with an indexing mechanism which, upon rotation of the driven spindle, coacts with any one of a plurality of indexing stops to lock the indexing mechanism and thus the driven spindle in any one of a plurality of rotary switch positions, and a release and driving mechanism operated by a driving rotary spindle to release the indexing mechanism from a locked position with a stop and then to turn the driven spindle round the indexing mechanism until the mechanism is locked in a new rotary switch position by engagement with another stop.

In conventional switches of the type described, the indexing mechanism comprises a locking spring of split ring form with spaced apart resilient ends which are turned out of the plane of the spring and these ends engage the indexing stops. It is found that the most suitable material for making these locking springs is phosphor bronze which is very costly material and it has been found that when other materials have been used as alternatives that the resultant disadvantages have shown that phosphor bronze is the only material which is practicable. Apart from this cost in material, it is known that switches incorporating these phosphor bronze locking springs need individual attention to ensure that each of the locking springs operates in a positive manner in the particular switch to which it is fitted. Of particular importance is the determination of the angle of the ends of each spring with regard to the stops themselves and final adjustment may be required to individual switches before they operate in a satisfactory manner. This, of course, increases the labour costs. Another disadvantage is that because of the constructional features of the mechanism, a lot of resistance to positive operation is provided by friction between the indexing spring and parts of the housing. It is clear that this resistance operates against positive action of the spring.

The present invention is an improvement in or modification of the invention described in the patent specification of Patent No. 1 342 392. The said specification relates to a switch of the type described having an indexing mechanism comprising at least one indexing element movable radially in a guide secured to the driven spindle and element spring means urging the element in a radially outwards direction, the element engaging one of a plurality of stops when disposed in a radially outward position by the element spring means, and the release and driving mechanism comprises at least one release element, the or each release element being rotatable by a driving spindle and engageable during its rotation with an abutment on the or each indexing element to urge the indexing element radially inwards against the action of the element spring means, and a driving spring which is strained during rotation of the release element and causes the indexing element and the driven spindle to rotate after movement of the indexing element radially inwards away from one stop, rotation ceasing when the indexing element engages another stop.

In the said specification there is described a switch of which the indexing elements have their radially outward ends provided with chamfered edges to enable the elements to line themselves accurately through slots provided between circumferentially spaced arcuate flanges of a stop plate whereby each side of a slot forms a stop for an indexing element.

In use of such a switch as described, an indexing element is rotated under the effect of the driving spring from one switch position to another. As the element approaches a

selected switch position, the radially outer and chamfered end of the element begins to enter the appropriate slot. However, because of the chamfered edge on the shoulder of the element facing in the direction of rotation and the force of the driving spring, there is a tendency for the element to partly enter the slot but immediately to move out again thereby riding over and beyond the slot.

An object of the present invention is to minimise the tendency for the indexing element to move beyond a desired selected position.

According to the present invention, a switch of the type described has an indexing mechanism comprising at least one indexing element movable radially in a guide secured to the driven spindle and element spring means urging the element in a radially outwards direction, the element engaging one of a plurality of stops when disposed in a radially outward position by the element spring means, the radially outer end portion of the indexing element comprising a stop-engaging surface on one side of the element which is substantially parallel with the direction of radial movement of the element, and the opposite side of the element being chamfered to facilitate engagement of the end portion with a stop, and the release and driving mechanism comprises a release member which is rotatable by the driving spindle in a direction such that the stop engaging surface of the indexing element is facing in the said direction of rotation, the release member being engageable during its rotation with an abutment on the or each indexing element to urge the indexing element radially inwards against the action of the element spring means, and a driving spring which is strained during rotation of the release member and causes the indexing element and the driven spindle to rotate after movement of the indexing element radially inwards away from one stop, rotation ceasing when the indexing element engages another stop by movement of the element radially outwards to bring the stop-engaging surface into engagement with said other stop.

In order to facilitate actuation of the indexing mechanism in both directions of spindle rotation it is advantageous that the mechanism comprises two indexing elements at diametrically opposed positions with the stop-engaging surfaces of the elements facing in opposite directions of rotation of the spindles.

Preferably the release member coacts with the indexing elements by cam means to urge the indexing elements radially inwards.

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an axial cross-sectional view along line I—I of Figure 2 of part of a switch showing the driving and indexing mechanisms with part of a release and driving mechanism omitted;

Figure 2 is a lateral cross-sectional view in the direction of arrow 'A' in Figure 1 of a driving mechanism and indexing elements of the indexing mechanism locked in position by stops;

Figure 3 is an elevational view showing part of the release and driving mechanism omitted from Figure 1;

Figure 4 is a lateral cross-sectional view in the direction of arrow 'B' of parts shown in Figure 3;

Figure 5 is a lateral cross-sectional view similar to Figure 2 and showing part of the release mechanism contacting an abutment of an indexing element when commencing to move the element from the top, and

Figure 6 is a plan view of an indexing element.

As shown in Figure 1, a rotary electric switch comprises an assembly of casings 1 enclosing switching members, the casings being disposed axially of one another along a driven spindle 2. At the end end of the assembly of casings, a flanged housing 3 is mounted and a cover 4 encloses the switch indexing mechanism 5 which is housing by the housing 3.

The indexing mechanism 5 comprises two indexing elements in the form of bolts 6*a* and 6*b* of rectangular cross-section and which are diametrically opposed with respect to the axis of rotation of the driven spindle 2 and are slidable within complementary shaped recesses 7 formed in a guide constituted by a carrier plate 8 which is secured to the driven spindle 2. Spring means in the form of compression springs 9 are engaged against the inner ends of the recesses 7 and operate in bores 10 of the two bolts 6*a*, 6*b*, to urge them radially outwards along the recesses 7. The radially outer end portion of each bolt (Figures 2 and 6) has a stop-engaging surface 11 on one side of the bolt which faces in one direction of rotation of the spindle 2, and the opposite side 12 of the bolt has chamfers 13, 14 to form a tapering end portion. In this embodiment the chamfer 13 forms an angle of 150° with the side 12, and the chamfer 14 forms an angle of 120° with the side 12, the chamfer 14 leaving a land 15 which lies at 90° to the side 11. The chamfers enable the bolts to enter slots 16 provided at four positions in the inner surface 17 of an annular stop plate 18 which is mounted upon the housing 3. The sides of the slots 16 provide a bearing surface and a stop for the bolts 6*a*, 6*b*. Conveniently the stop plate 18 may be cast from an aluminium

alloy. It will be seen from Figure 2 of the drawings that the two balts 6*a*, 6*b* have their stop-engaging surfaces 11 facing in opposite directions of rotation of the spindle 2. Each bolt has an axially extending abutment in the form of a peg 19.

A cover plate 20 is secured to the driven spindle 2 and extends across the recesses 7 in the carrier plate 8 thereby retaining the bolts in the recesses. The plate 20 includes two axially extending ears 21, 21*a* conveniently formed by lancing and bending portions of the plate.

A release and driving mechanism for the driven spindle 2 comprises a bolt release member 22 (Figures 3 and 4) which is of composite construction and comprises an end plate 23 secured to a driving spindle 24 which extends through the cover 4. The plate has two axially extending lugs 25 and two cam plates 26 as shown in Figure 4. It will be seen that each cam plate comprises two inclined wings 27. The bolt release member is completed by the provision of a support ring 28 welded to the lugs 25 and plates 26. The release member is contained within the cover 4 and the wings 27 extend into the same radial plane as the pegs 19 of the bolts 6*a*, 6*b*. As shown in Figure 5, the position and angular relationship of the wings 27 is arranged so that rotation of the member 22 will cause the radially inner surfaces of the wings to co-act with the pegs 19 and move the bolts 6*a*, 6*b* radially inwardly against the force of the springs 9. An operating handle 29 is mounted on the outer end of the driving spindle 24.

The release and driving mechanism also comprises two driving springs 30 each of which is a spiral torsion spring, the centre of which is secured to a bush 31 of square external profile and which is freely rotatably mounted upon a cylindrical extension 32 of the driven spindle 2. The springs are axially superimposed upon one another as shown in Figure 2. The outer ends of the springs are shaped into hooks 33. Axially disposed between the two springs, there are two arms 34, 35 mounted on the bush 31, the arm 34 having a square bore so as to be non-rotatable relative to the bush, and the arm 35 having a circular bore so as to be freely rotatable around the bush. Each arm has a free end portion which extends axially of the switch, with one side face 36 of the end portion engaging the ears 21, 21*a* of the cover plate 20. The faces 36 are also engageable by the lugs 25 of the release member 22. The opposite face of the end portion of the arm 35 also engages with the hooks 33 of the springs 30.

In use of the switch with the two bolts 6*a*, 6*b* disposed in diametrically opposite slots 16 of the stop plate 18 as shown in Figure 2, it is desired to operate the switch to the next switch position in one direction of rotation. To effect this, the switch handle 29 is rotated to move the release member 22 in a clockwise direction as viewed in Figure 2. The movement of the member 22 causes a lug 25 thereof to rotated the arm 35 so as to rotate the outer end of the spring 30 while the inner end of the spring is held in position by the bush 31 and the arm 34 which, in turn, is prevented from rotating under the influence of the spring by the ear 21*a* of the plate 20. As shown in Figure 5 continued rotation of the member 22 brings the cam plates 26 with their wings 27 into engagement with the pegs 19 of the bolts, which move the bolts radially inwardly until they are released from their respective slots 16. At this moment, the springs 30 urge the cover plate and the carrier plate in the clockwise direction until the bolts enter the next adjacent slots 16 disposed around the stop plate 18. The bolt 6*b* enters a slot 16 so that its stop-engaging surface 11 engages a stop at one side of the slot, the chamfers 13, 14 allowing the bolt to move radially outwardly into the slot whilst the bolt is approaching the end of its rotational movement with respect to the housing 3. At the end of the rotational movement, the other bolt 6*a* moves into its respective slot. By virtue of the stop engaging surface 11 of the bolt 6*b* being formed by one side of the bolt and thus parallel with the direction of radial movement of the bolt, the end portion of the bolt enters the slot without any tendency for the bolt to move out of, and ride over the slot.

The switch is alternatively operable to change the switch positions in the opposite direction of rotation of the release member 22. This is effected by rotating the switch handle 29 in an anti-clockwise direction whereby a lug 25 of the release member rotates the arm 34 which rotates the bush 31 and thereby the inner ends of the springs 30 while the outer ends of the springs are restrained against rotation by the ear 21 and the arm 35. This again has the effect of tensioning the springs 30 so that immediately the bolts are released from their slots by the action of the wings 27 against the pegs 19, the springs urge the cover plate and carrier plate in the anti-clockwise direction until the bolts locate within and occupy the next adjacent slots 16 around the plate 18. In this instance, the bolt 6*a* operates in a similar manner to that described above for the bolt 6*b*.

In a modification, the cam means of operating the radially inward movement of the indexing elements is different in that a cam slot is formed in each indexing element. Projections which extend axially from a release member enter into the cam slots during rotation of the driving shaft and move

along the slots so as to move the indexing elements radially inwards.

WHAT WE CLAIM IS:—

1. A switch of the type described having an indexing mechanism comprising at least one indexing element movable radially in a guide secured to the driven spindle and element spring means urging the element in a radially outwards direction, the element engaging one of a plurality of stops when disposed in a radially outward position by the element spring means, the radially outer end portion of the indexing element comprising a stop-engaging surface on one side of the element which is substantially parallel with the direction of radial movement of the element, and the opposite side of the element being chamfered to facilitate engagement of the end portion with a stop, and the release and driving mechanism comprises a release member which is rotatable by the driving spindle in a direction such that the stop engaging surface of the indexing element is facing in the said direction of rotation, the release member being engageable during its rotation with an abutment on the or each indexing element to urge the indexing element radially inwards against the action of the element spring means, and a driving spring which is strained during rotation of the release member and causes the indexing element and the driven spindle to rotate after movement of the indexing element has been moved radially inwards away from one stop, rotation ceasing when the indexing element engages another stop by movement of the element radially outwards to bring the stop-engaging surface into engagement with said other stop.

2. A switch according to claim 1 wherein two diametrically opposed indexing elements are provided, each indexing element having a stop-engaging surface with the stop engaging surfaces of the elements facing in opposite directions of rotation of the spindles.

3. A rotary electric switch constructed and arranged substantially as described herein and shown in the accompanying drawings.

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Agent for the Applicants.

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1485002 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

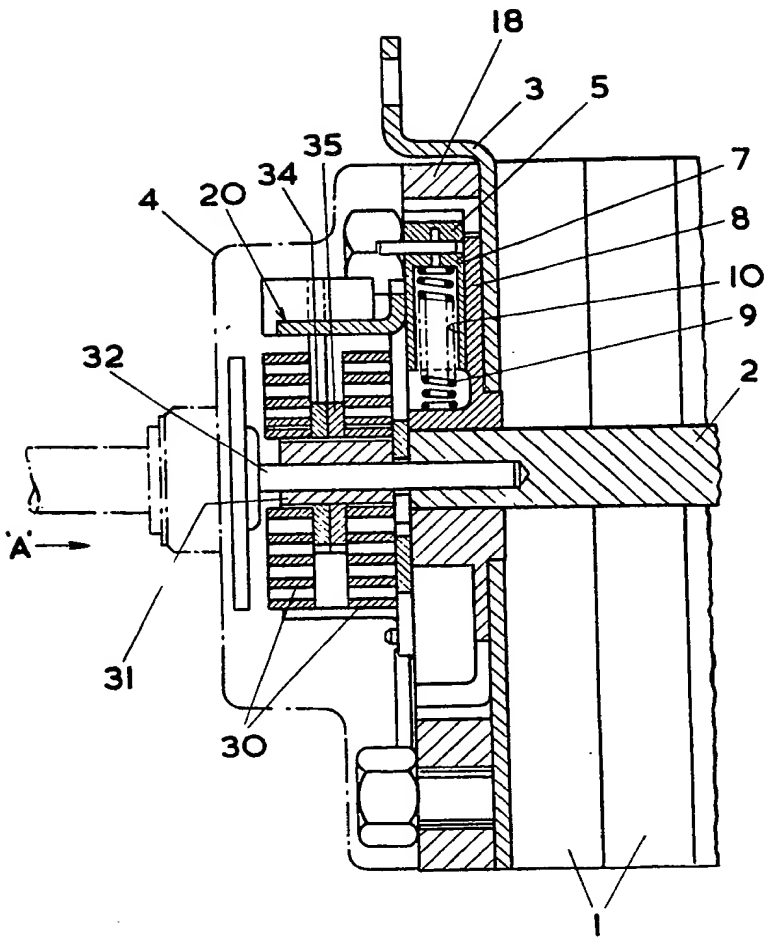

FIG. 1

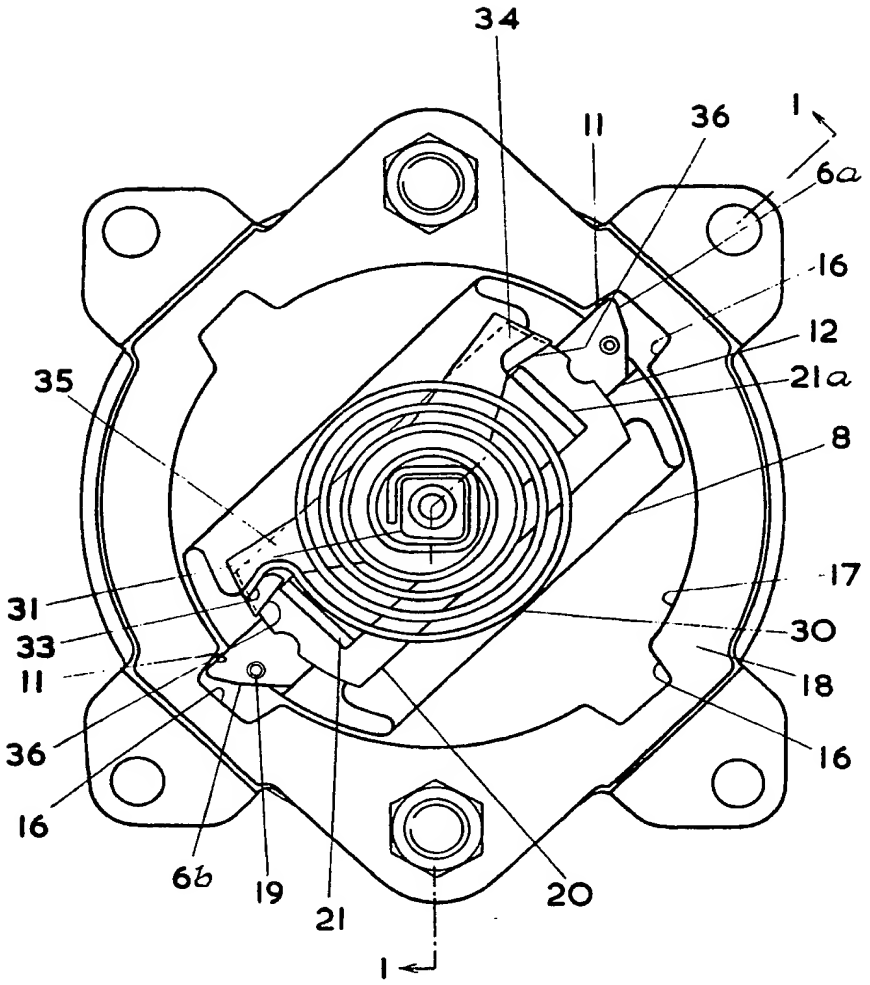

FIG. 2

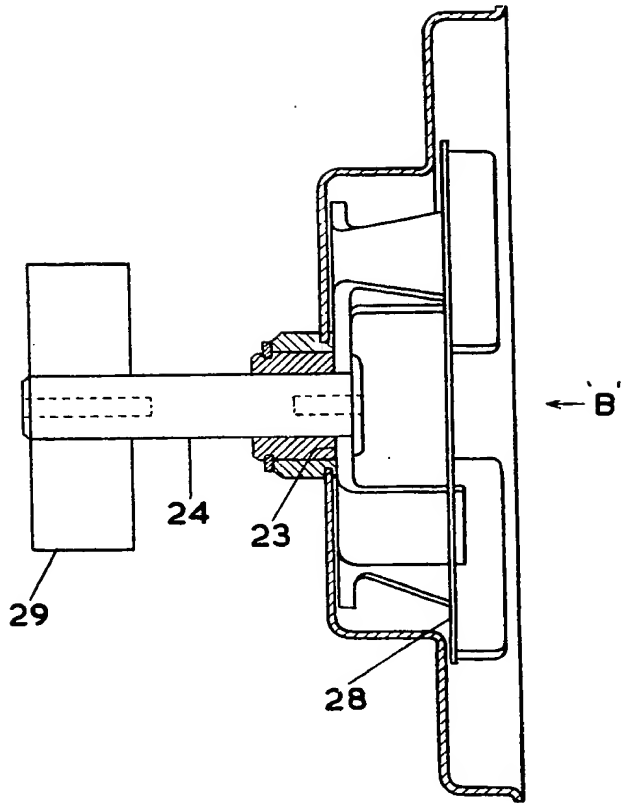

FIG. 3

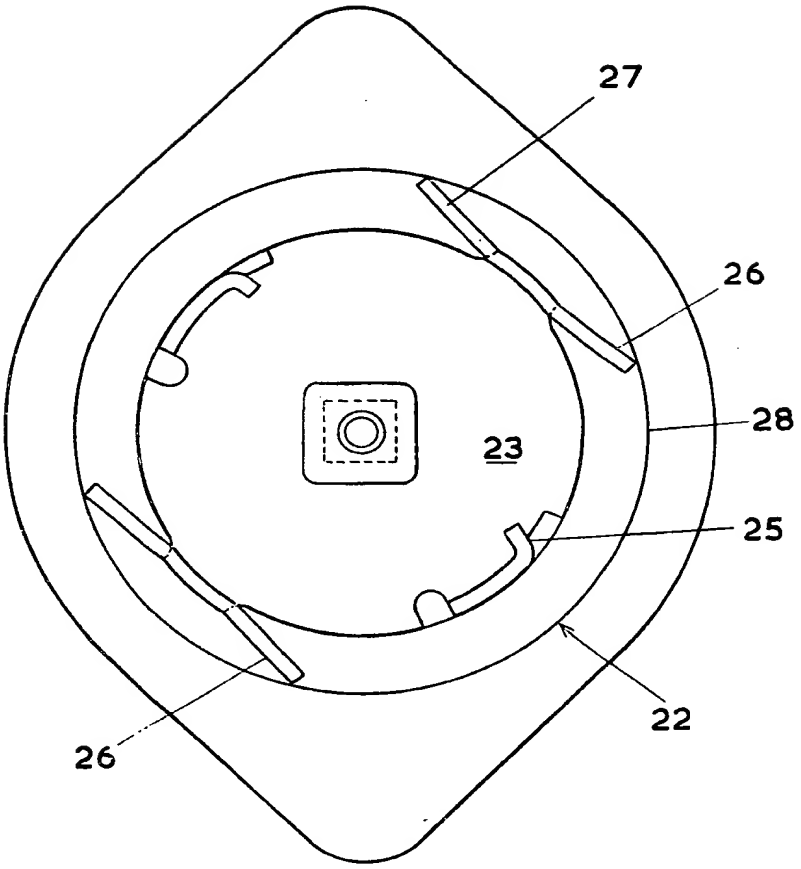

FIG. 4

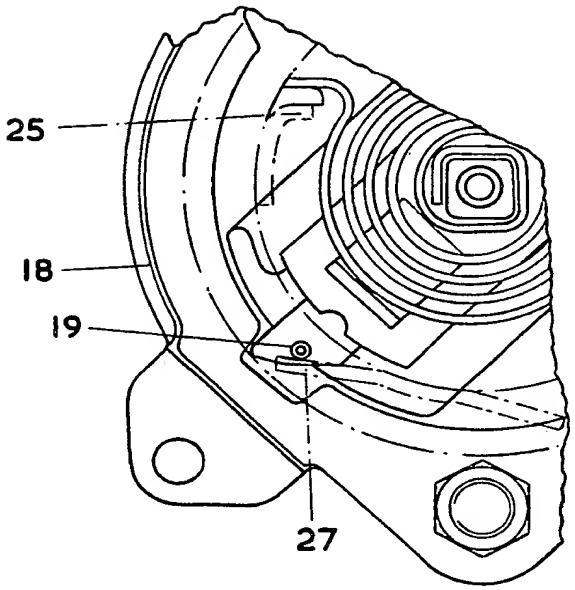

FIG. 5

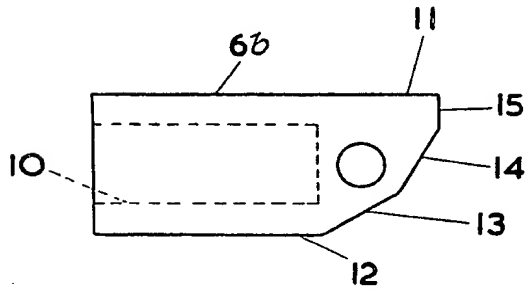

FIG. 6